UK Patent Application (19) GB (11) 2 208 955 (13) A

(12)

(21) Application No 8719570.7

(22) Date of filing 19.08.1987

(71) Applicant
The General Electric Company PLC

(Incorporated in the United Kingdom)

1 Stanhope Gate, London, W1A 1EH, United Kingdom

(72) Inventors
Alan John Jones
Simon Clegg

(74) Agent and/or Address for Service
M B W Pope
The General Electric Company PLC, Central Patent
Dept (Wembley Office), Hirst Research Centre, East
Lane, Wembley, Middlesex, HA9 7PP, United Kingdom

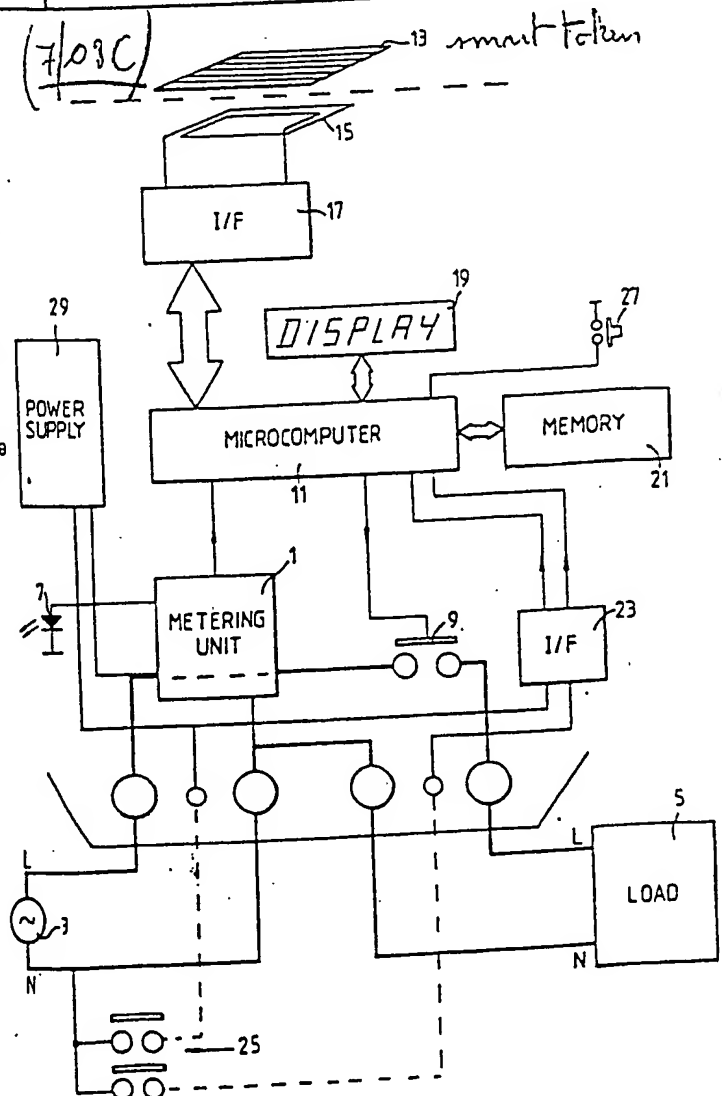(51) INT CL⁴
G07F 7/08

(52) UK CL (Edition J)
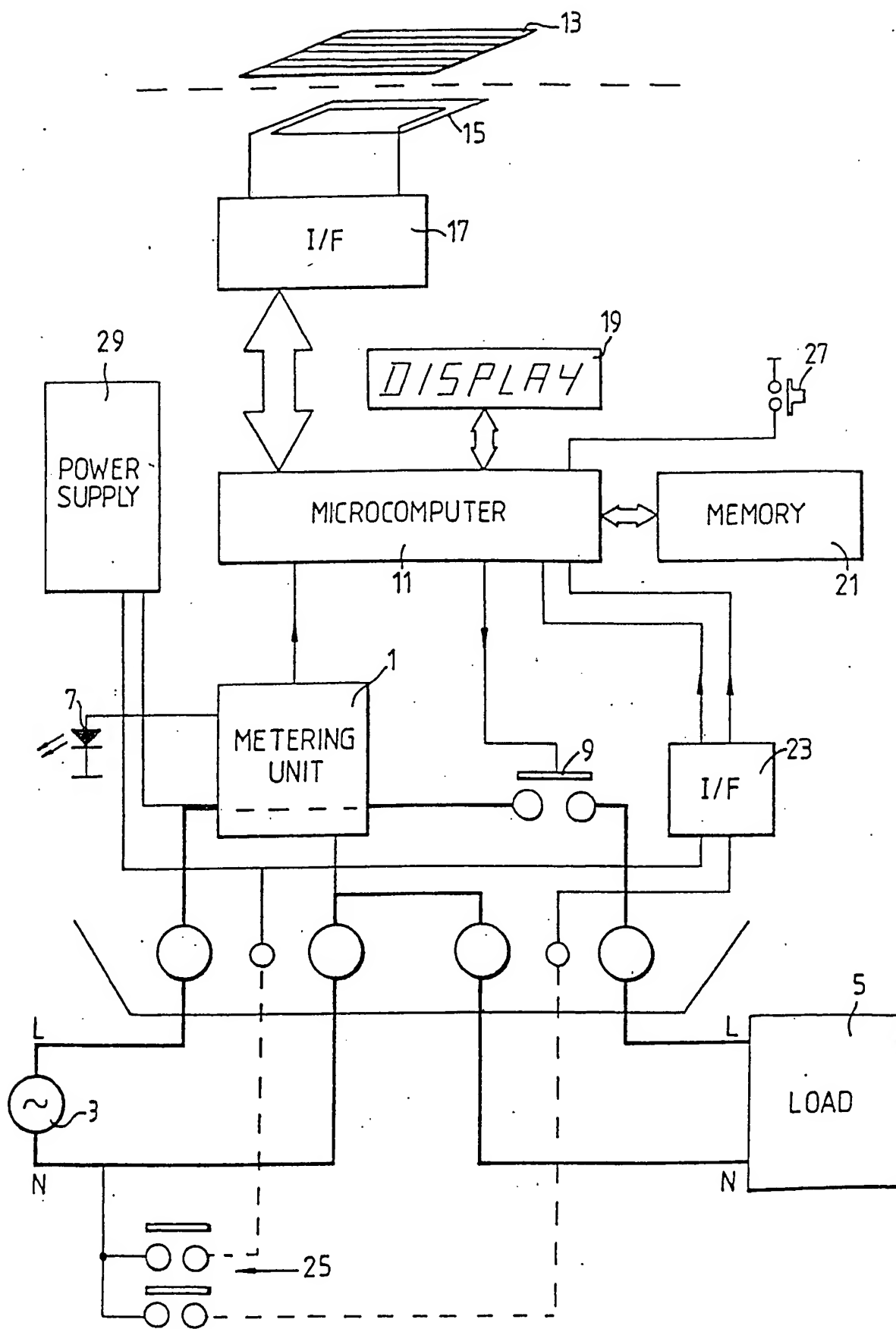G4V VAL V111

(56) Documents cited
GB 2173623 A   GB 1572051 A   GB 1558521 A
GB 1522587 A   GB 1371062 A   WO 85/04035 A1

(58) Field of search
UK CL (Edition J) G4V
INT CL⁴ G07F

(54) Prepayment systems for supply of a commodity

(57) A prepayment system of the kind wherein on presentation to a consumer's metering equipment of a token (13), e.g. a card of key, which the consumer has previously purchased, the consumer is allowed to consume a quantity of a commodity e.g. electricity, gas or water, determined by encoded credit data on the token, in which the token is arranged to receive data from the metering equipment, as well as carry data for reading by the metering equipment. The data received by the token may then subsequently be read by equipment at a point of purchase of further credit thus providing the supply authority with information about the use of the commodity by the use consumer, e.g. use in excess of credit purchase.

13

15

I/F 17

29

DISPLAY 19

27

POWER SUPPLY

MICROCOMPUTER 11

MEMORY

21

7

METERING UNIT

1

9

I/F 23

25

L

~ 3

N

5

LOAD

L

N

Prepayment systems for supply of a commodity

This invention relates to prepayment systems for supply of a commodity, e.g. water, electricity or gas.

In the past such systems have been operated by insertion of coins into a consumer's metering equipment which cause the equipment to allow consumption of a quantity of the commodity corresponding to the value of the coins inserted.

More recently, systems have been developed which are operated by the presentation to a consumer's metering equipment of a token, e.g. a card or key, representing credit which the consumer has previously purchased, the token carrying encoded data which the metering equipment reads to determine the value of the credit, and hence the quantity of the commodity which the consumer is to be allowed to consume. Such a system is hereafter referred to as a prepayment system of the kind specified.

It is an object of the present invention to provide an improved form of prepayment system of the kind specified.

According to the present invention in a prepayment system of the kind specified the token is arranged to receive data from the metering equipment on presentation thereto as well as to carry data for reading by the metering equipment on presentation thereto.

Preferably said data received from the metering equipment on presentation thereto relates to the supply of the commodity by the equipment prior to said presentation.

In one particular embodiment of the invention the data received by the token from the metering equipment is utilised to modify the data carried by the token for reading by the metering equipment. Alternatively or additionally the system may include means at a point of purchase of credit adapted to read the data received by the token from the metering equipment.

One prepayment system in accordance with the invention for the supply of electricity to a consumer will now be described by way of example with reference to the accompanying drawing which is a block schematic diagram of a consumer's metering equipment of the system.

Referring to the drawing, the metering equipment includes an electronic watt-hour metering unit connected between an electricity supply 3 and the load 5 which the consumer wishes to connect to the supply. The metering unit 1 provides an output comprising a series of pulses each pulse representing the consumption of a predetermined amount of electrical energy e.g. 1/100 of a kilowatt hour.

The metering unit 1 is associated with a light emitting diode 7 which flashes each time a pulse appears at the output of the unit to provide the consumer with a visual indication of the rate of consumption of energy.

Between the metering unit 1 and the load 5 there is a contactor 9, connected in the live lead L to the load, which is operated by a microcomputer 11 in dependence on data received by the microcomputer 11 from the metering unit 1 and from tokens 13 presented to the equipment.

The tokens 13 are of the kind which have on-board data processing capability, e.g. comprise so-called Smart cards, and are adapted to communicate with the microcomputer 11 via an inductive loop 15 and an interface 17, rather than by direct electric contact with terminals of the equipment.

Essentially the tokens each comprise a microcomputer and a non-volatile memory element (not shown) in which the application programme and data required are stored. The power needed to energise the token is suitably derived from the equipment via its inductive coupling thereto. One suitable form of token is described in UK patent specification GB 2,173,623 A.

The microcomputer 11 is further connected with a display 19, a non-volatile memory 21, for displaying and storing data computed in the microcomputer 11, a second interface 23 which buffers external time control circuits 25 from the microcomputer 11, and an emergency

5 credit switch 27. Operation of the switch 27 allows consumption of a predetermined amount of electricity if the consumer runs out of credit.

Finally, the metering equipment includes a power supply 29 for the various components of the equipment, the supply being

10 energised from the electricity supply 3 on the supply side of the metering unit 1.

In operation, the basic function of the equipment is to close the contactor 9 when a token or tokens having a credit value in excess of the energy consumed, as indicated by the metering unit 1, have been

15 presented to the equipment, i.e. to the inductive loop 15, and to open the contactor 9 when credit is exhausted. To this end the metering unit monitors the consumption of energy in conventional manner, and the microcomputer 11 reduces the consumer's credit in accordance with the consumption and the tariff prevailing at the time of consumption.

20 Changes in tariff with the time of day are indicated to the microcomputer 11 by the operation of external time circuits 25.

When first installed the equipment is commissioned by presenting a special token to the inductive loop 15 carrying data to effect the following operation:-

25   Zero all registers in equipment

Enter meter identity

Enter reference code for transaction

Enter number of different tariffs

Enter price per kilowatt hour for each tariff

Enter emergency credit value

30   Enter initial credit to permit checking operation of equipment.

At any time after commissioning the consumer can present a token to the meter to allow consumption of electricity up to a value

35 set by the token.

On first obtaining a token from the supply authority the

consumer inserts the token in a dispenser (not shown) linked to a computer system operated by the supply authority. On purchasing credit, e.g. by inserting coins into the dispenser, the dispenser supplies data to the token to effect the following operations:-

Enter consumer's meter identity on token

Enter reference code for transaction on token

Zero all data registers and indicator flags on token

Enter emergency credit value allowed for consumer on token

Enter price per kilowatt for each tariff on token

Enter value of credit purchased by consumer on token.

On presentation of a valid token to the equipment data on the card is transferred to the equipment. After checking the validity of the card, e.g. correct meter identity, the display 19 first shows the credit value of the token, and then the net value of credit, i.e. the amount of any credit in the equipment plus the credit value of the token, or the credit value of the token less the amount of any emergency credit obtained by operating switch 27. After the successful entry of credit from the token a signal is passed by the installation to the token to erase the token's credit value.

If the equipment is already loaded with a large amount of credit, the token may yield up part only or none of its credit, leaving the token valid for further entry of credit on later presentation to the equipment.

In addition to passing data to the equipment, the token also receives data from the equipment as follows:

Meter identity

Cumulative total kilowatt hours registered by equipment

Cumulative kilowatt hours registered by the equipment at each tariff

Kilowatt hours registered by the equipment at each tariff since last credit entry

Reference code for previous transaction

Emergency credit limit

Price per kilowatt hour for each tariff

Status of various indicator flags of the equipment indicating whether certain events have occurred since last credit entry e.g. power failure; reverse power flow; anti-tamper circuit operation.

When the token is next presented to a dispenser for the purchase of further credit, all the above data received by the token from the equipment is passed to the dispenser and hence to the supply authority computer system, together with an indication of any unused credit remaining on the token. The dispenser then clears the relevant registers on the token in preparation for supplying data to the token when new credit is purchased, as described above.

It will be appreciated that using the token to carry data from the consumer's metering equipment to the dispener, and hence to the supply authority's computer systems, is of considerable value.

Thus the readings of the metering unit 1 of the equipment taken when the consumer enters credit and subsequently passed to the supply authority computer when the token is next presented to a dispenser allow a comparison to be made automatically between the value of credit purchased by a consumer and the value of electricity actually used by that consumer. Any discrepancy can then be noted and appropriate action taken.

The readings of the equipment indicator flags taken when credit is entered by the consumer and subsequently passed to the supply authority computer when the token is next presented to a dispenser also alert the supply authority to maloperation of the equipment and fraudulent extraction of energy from the equipment.

In addition to serving merely to carry data from the consumer's equipment to a dispenser, the token may be arranged to make intelligent decisions depending on the data it receives from the customer's equipment.

For example, the token may be arranged to detect if the equipment has recorded consumption of an amount of electricity that is greater than the amount of credit previously entered, and make the amount of credit entered correspondingly smaller than the credit value of the card. This decision will then be reported to the supply authority when the token is next presented to a dispenser.

CLAIMS

1.   A prepayment system of the kind specified wherein the token is arranged to receive data from the metering equipment on presentation thereto as well as to carry data for reading by the metering equipment on presentation thereto.

2.   A system according to Claim 1 wherein said data received from the metering equipment on presentation thereto relates to the supply of the commodity by the equipment prior to said presentation.

3.   A system according to Claim 1 or Claim 2 wherein said data received by the token from the metering equipment is utilised to modify the data carried by the token for reading by the metering equipment.

4.   A system according to any one of the preceding claims including means at a point of purchase of credit adapted to read the data received by the token from the metering equipment.

5.   A system according to any one of the preceding claims wherein said token carries on-board data processing capability.

6.   A system according to any one of the preceding claims wherein said token is adapted to be inductively coupled to said metering equipment.

7.   A system according to any one of the preceding claims wherein said commodity is electricity, gas or water.

8.   A prepayment system for supply of a commodity substantially as hereinbefore described with reference to the accompanying drawing.